

# INTERNATIONAL STANDARD

---

**Industrial communication networks – Fieldbus specifications –  
Part 3-4: Data-link layer service definition – Type 4 elements**



## **THIS PUBLICATION IS COPYRIGHT PROTECTED**

**Copyright © 2023 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

### **About the IEC**

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### **About IEC publications**

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

#### **IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)**

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

#### **IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)**

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

#### **IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)**

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

#### **IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)**

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

#### **Electropedia - [www.electropedia.org](http://www.electropedia.org)**

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.



IEC 61158-3-4

Edition 4.0 2023-03

# INTERNATIONAL STANDARD

---

**Industrial communication networks – Fieldbus specifications –  
Part 3-4: Data-link layer service definition – Type 4 elements**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 25.040.40; 35.100.20; 35.110

ISBN 978-2-8322-6575-8

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

|                                                                                |    |
|--------------------------------------------------------------------------------|----|
| FOREWORD.....                                                                  | 4  |
| INTRODUCTION.....                                                              | 6  |
| 1 Scope.....                                                                   | 7  |
| 1.1 General.....                                                               | 7  |
| 1.2 Specifications .....                                                       | 7  |
| 1.3 Conformance .....                                                          | 7  |
| 2 Normative references .....                                                   | 8  |
| 3 Terms, definitions, symbols, abbreviated terms and conventions .....         | 8  |
| 3.1 Reference model terms and definitions .....                                | 8  |
| 3.2 Service convention terms and definitions .....                             | 9  |
| 3.3 Data-link service terms and definitions.....                               | 10 |
| 3.4 Symbols and abbreviations .....                                            | 12 |
| 3.5 Conventions.....                                                           | 13 |
| 4 Data-link service and concepts .....                                         | 14 |
| 4.1 Overview.....                                                              | 14 |
| 4.1.1 General .....                                                            | 14 |
| 4.1.2 Overview of DL-naming (addressing) .....                                 | 14 |
| 4.2 Types and classes of data-link service .....                               | 15 |
| 4.3 Functional classes .....                                                   | 15 |
| 4.4 Facilities of the connectionless-mode data-link service .....              | 15 |
| 4.5 Model of the connectionless-mode data-link service.....                    | 15 |
| 4.5.1 General .....                                                            | 15 |
| 4.5.2 Unconfirmed request .....                                                | 15 |
| 4.5.3 Confirmed request .....                                                  | 16 |
| 4.6 Sequence of primitives.....                                                | 16 |
| 4.6.1 Constraints on sequence of primitives .....                              | 16 |
| 4.6.2 Relation of primitives at the end-points of connectionless service ..... | 17 |
| 4.6.3 Sequence of primitives at one DLSAP.....                                 | 18 |
| 4.7 Connectionless-mode data transfer functions.....                           | 18 |
| 4.7.1 General .....                                                            | 18 |
| 4.7.2 Types of primitives and parameters .....                                 | 18 |
| 5 DL-management service .....                                                  | 21 |
| 5.1 Scope and inheritance .....                                                | 21 |
| 5.2 Facilities of the DL-management service.....                               | 21 |
| 5.3 Model of the DL-management service .....                                   | 21 |
| 5.4 Constraints on sequence of primitives.....                                 | 21 |
| 5.5 Set.....                                                                   | 22 |
| 5.5.1 Function .....                                                           | 22 |
| 5.5.2 Types of parameters .....                                                | 22 |
| 5.6 Get .....                                                                  | 23 |
| 5.6.1 Function .....                                                           | 23 |
| 5.6.2 Types of parameters .....                                                | 23 |
| 5.7 Action .....                                                               | 23 |
| 5.7.1 Function .....                                                           | 23 |
| 5.7.2 Types of parameters .....                                                | 24 |
| 5.7.3 Sequence of primitives .....                                             | 24 |

|       |                                                                                    |    |
|-------|------------------------------------------------------------------------------------|----|
| 5.8   | Event .....                                                                        | 25 |
| 5.8.1 | Function .....                                                                     | 25 |
| 5.8.2 | Types of parameters .....                                                          | 25 |
|       | Bibliography.....                                                                  | 26 |
|       | Figure 1 – Relationship of PhE, DLE and DLS-users .....                            | 14 |
|       | Figure 2 – Confirmed and unconfirmed UNITDATA request time-sequence diagram .....  | 17 |
|       | Figure 3 – Repeated confirmed request time-sequence diagram .....                  | 17 |
|       | Figure 4 – State transition diagram for sequences of primitives at one DLSAP ..... | 18 |
|       | Figure 5 – Sequence of primitives for the DLM action service .....                 | 21 |
|       | Table 1 – Summary of DL-connectionless-mode primitives and parameters .....        | 17 |
|       | Table 2 – Unitdata transfer primitives and parameters .....                        | 18 |
|       | Table 3 – Control-status error codes .....                                         | 20 |
|       | Table 4 – Summary of DL-management primitives and parameters .....                 | 22 |
|       | Table 5 – DLM-Set primitive and parameters .....                                   | 22 |
|       | Table 6 – DLM-Get primitive and parameters .....                                   | 23 |
|       | Table 7 – DLM-Action primitive and parameters .....                                | 24 |
|       | Table 8 – DLM-Event primitive and parameters.....                                  | 25 |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –  
FIELDBUS SPECIFICATIONS –****Part 3-4: Data-link layer service definition –  
Type 4 elements****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

Attention is drawn to the fact that the use of the associated protocol type is restricted by its intellectual-property-right holders. In all cases, the commitment to limited release of intellectual-property-rights made by the holders of those rights permits a layer protocol type to be used with other layer protocols of the same type, or in other type combinations explicitly authorized by its intellectual-property-right holders.

NOTE Combinations of protocol Types are specified in the IEC 61784-1 series and the IEC 61784-2 series.

IEC 61158-3-4 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2019. This edition constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition:

- a) Use of extended data size for DLS-user data. This extension is restricted to nodes operating on a P-NET IP network.

The text of this International Standard is based on the following documents:

| Draft         | Report on voting |
|---------------|------------------|
| 65C/1201/FDIS | 65C/1242/RVD     |

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

A list of all the parts of the IEC 61158 series, under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC web site.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

## INTRODUCTION

This document is one of a series produced to facilitate the interconnection of automation system components. It is related to other standards in the set as defined by the "three-layer" fieldbus reference model described in IEC 61158-1.

Throughout the set of fieldbus standards, the term "service" refers to the abstract capability provided by one layer of the OSI Basic Reference Model to the layer immediately above. Thus, the data-link layer service defined in this document is a conceptual architectural service, independent of administrative and implementation divisions.

## **INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –**

### **Part 3-4: Data-link layer service definition – Type 4 elements**

## **1 Scope**

### **1.1 General**

This part of IEC 61158 provides common elements for basic time-critical messaging communications between devices in an automation environment. The term "time-critical" is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the time window risks failure of the applications requesting the actions, with attendant risk to equipment, plant and possibly human life.

This document defines in an abstract way the externally visible services provided by the Type 4 fieldbus data-link layer in terms of

- a) the primitive actions and events of the services;
- b) the parameters associated with each primitive action and event, and the form which they take; and
- c) the interrelationship between these actions and events, and their valid sequences.

The purpose of this document is to define the services provided to

- the Type 4 fieldbus application layer at the boundary between the application and data-link layers of the fieldbus reference model;
- systems management at the boundary between the data-link layer and systems management of the fieldbus reference model.

### **1.2 Specifications**

The principal objective of this document is to specify the characteristics of conceptual data-link layer services suitable for time-critical communications, and thus supplement the OSI Basic Reference Model in guiding the development of data-link protocols for time-critical communications. A secondary objective is to provide migration paths from previously-existing industrial communications protocols.

This document can be used as the basis for formal DL-Programming-Interfaces. Nevertheless, it is not a formal programming interface, and any such interface will need to address implementation issues not covered by this specification, including

- a) the sizes and octet ordering of various multi-octet service parameters;
- b) the correlation of paired request and confirm, or indication and response, primitives.

### **1.3 Conformance**

This document does not specify individual implementations or products, nor does it constrain the implementations of data-link entities within industrial automation systems.

There is no conformance of equipment to this data-link layer service definition standard. Instead, conformance is achieved through implementation of the corresponding data-link protocol that fulfills the Type 4 data-link layer services defined in this document.